PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A61C 7/18, 7/02, 7/04 | A1

(11) International Publication Number: WO 96/28112

(43) International Publication Date: 19 September 1996 (19.09.96)

(21) International Application Number: PCT/AU96/00131

(22) International Filing Date: 8 March 1996 (08.03.96)

(30) Priority Data:
PN 1667 10 March 1995 (10.03.95) AU

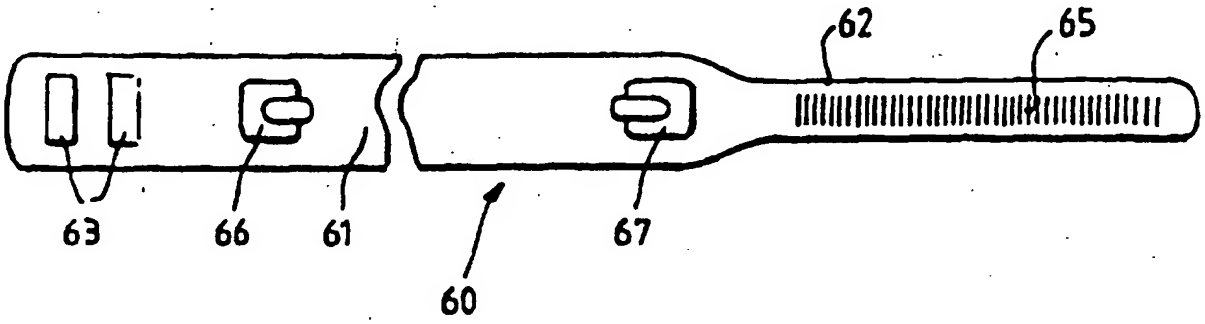
(71)(72) Applicants and Inventors: MUNRO, Donald, Malcolm [AU/AU]; 6 Scott Street, Kew, VIC 3101 (AU); SOON, Paul, Simon [AU/AU]; 142 Winmallee Road, Balwyn, VIC 3103 (AU).

(74) Agent: CARTER SMITH & BEADLE; Qantas House, 2 Railway Parade, Camberwell, VIC 3124 (AU).

(81) Designated States: AU, CA, SG, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: ORTHODONTIC BANDS



(57) Abstract

An orthodontic band (10) for placement on a molar tooth comprises a strip of flexible material (11), such as a stainless steel strip, having co-operating locking means (12, 13) located adjacent each end of the strip. Alternatively, the strip (60) may have an elongate tongue (62) formed at one end and slots (63, 64) for receiving the tongue at the other end. In use, the band is formed into a shape that will fit over a tooth and placed over the tooth. The band is then tightened to cause the band to closely fit to the tooth. An orthodontic cement is placed between the band and the tooth. The locking means (12, 13) on the band provides a frictional fit that may be sufficiently strong to hold the band in the desired configuration until the cement has set. Alternatively, the clamp may need to stay in place until the band and cement can provide a permanent set.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia
AT	Austria
AU	Australia
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CS	Czechoslovakia
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgystan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakhstan
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
MX	Mexico
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
SN	Senegal
SZ	Swaziland
TD	Chad
TG	Togo
TJ	Tajikistan
TT	Trinidad and Tobago
UA	Ukraine
UG	Uganda
US	United States of America
UZ	Uzbekistan
VN	Viet Nam

TITLE: ORTHODONTIC BANDS

The present invention relates to orthodontic bands, and in particular to orthodontic bands for placement on molar teeth. The invention also relates to a method for placement of orthodontic bands on teeth.

Fitment of braces to straighten the teeth of a patient involves a number of steps. In one procedure, the rear molar teeth are spread apart from each other by the use of spacers, such as plastic wedges, plastic O-rings or the like. After a period generally ranging from a few days to a week, the spacers are removed from the gaps between the molar teeth and molar bands are placed over the molars and cemented into place. The molar bands usually have brackets welded or otherwise fixed thereon and these brackets provide an anchoring point for wires that pass through further brackets cemented to the front teeth. Tensioning the wire over a period of many months causes the teeth to straighten.

The bands fitted to the molar teeth play an important role in this orthodontic procedure because they provide the foundation upon which tension is applied to the wires on the teeth. Molar bands currently used comprise a closed ring of metal that has been shaped and sized to closely fit over each tooth. As the shape and size of the molar teeth can vary greatly from patient to patient and because the size of each molar tooth of any given patient may be different to the other molar teeth of that patient, orthodontists must maintain a large inventory of molar bands in order to be able to treat each patient. This obviously places an undesirable cost burden on the orthodontist.

Furthermore, placement of the molar bands onto the molar teeth can be difficult. The molar bands are cemented onto the teeth and are intended to remain on the teeth for many months and even for years. Therefore, it is critical that each band fit closely to its respective tooth and is properly cemented in place. Poor cementing may cause the band to work loose over time, necessitating replacement. More importantly, if the band does not fit closely to the tooth and an adequate spread of cement between the tooth and the band is not obtained, gaps may exist between the tooth and the band. Such gaps are

potentially sites for serious tooth decay and must be avoided. Unfortunately, the method used for placing the band on a tooth, which involves coating the inside of the band with cement and then pushing the band onto the tooth, may leave areas where there is not sufficient cement to fully coat the tooth and the band.

The present invention provides an orthodontic band that is intended to overcome, or at least ameliorate, the above disadvantages.

In a first aspect, the present invention provides an orthodontic band for placement on a molar tooth comprising a strip of flexible material having co-operating locking means located at, adjacent, or near to each end of the strip of flexible material.

Preferably, the locking means is a self locking device, such as a friction fit arrangement. Such locking devices limit reopening when in position and are self locking in that they lock when activated and require no adjustments other than correct fitting of the band. Examples of suitable devices for use as the locking means include a wire and tube arrangement in which a wire located at or near one end of the strip is adapted to be received in and held by a tube located at or near the other end of the strip. A ratchet mechanism, such as a sawtooth extension receivable in a co-operable receiving means, may also be used. It will be appreciated that a large number of locking means other than those specifically described may be used in the present invention and the invention extends to cover all suitable locking means. It should be kept in mind that the preferred locking mechanisms are self locking and include one part located at or near one end of the strip and a co-operating other part located at or near the other end of the strip. A plurality of locking members may be employed, if desired.

In another aspect, the present invention provides an orthodontic band for placement on a molar tooth comprising a strip of flexible material having an elongate extension at one end thereof and one or more slots formed in said solid material at or near the other end thereof, said one or more slots adapted to receive the elongate extension.

Preferably, the elongate extension includes means to increase the strength of a friction fit between the elongate extension and the one or more slots. This may comprise serrations or saw-teeth formed on the elongate extension, or a surface-roughened surface, for example, as may be formed by surface etching.

The orthodontic band of the present invention is intended to be placed on a tooth by shaping the band to a size and shape that is slightly larger than the tooth upon which it is to be placed. The band is subsequently placed over the tooth and tightened to fit snugly over the tooth. The band can be adjusted for size over a small range, thus accommodating a range of sizes of molar teeth. It is also envisaged that the band will be produced in three or four sizes per posterior tooth, ranging from small to large, in order to accommodate different patients having differently sized teeth (to other patients). Thus, the present invention may require that the orthodontist stock only three or four bands per posterior tooth, which is a great reduction compared to conventional closed ring bands currently used, it being noted that it is necessary to stock in excess of thirty bands per tooth with the current, closed-ring bands.

The orthodontic bands of the present invention may be made from any suitable material that is sufficiently flexible to allow the band to be correctly placed on the tooth. The material should also be sufficiently strong to provide a sound anchor for the wires of the braces. Metals and alloys that are used in the construction of current closed ring bands, such as various grades of stainless steel, are suitable for producing the orthodontic bands of the present invention.

Many orthodontic procedures utilise molar bands that incorporate lingual cleats and/or buccal brackets thereon. In an especially preferred embodiment of the invention the locking means of the orthodontic band also acts as the lingual cleat(s) or the buccal bracket(s). Alternatively, the band may be separately provided with lingual cleats or buccal brackets(s).

The orthodontic band is preferably shaped to be contoured on its inner surface to enable the band to closely fit to the tooth. The contour may include a concave surface on the inner

surface of the orthodontic band. Placement of the band on the tooth also involves the step of closing the locking mechanism by tensioning the band and this also causes the band to more closely conform to the outer profile of the tooth. Indeed, the band may be designed to undergo a small degree of plastic deformation when placed over the tooth and tensioned in order to ensure a close fit with the tooth.

Therefore, preferred embodiments of the band enable the band to adapt more closely superiorly and inferiorly than current closed ring bands and thus assist in obtaining an even layer of cement and a tight adaptation of the band to the tooth to lessen plaque accumulation and gingivitis. This also assists in ensuring that the full width of the band is cemented to the tooth.

As a further advantage, the orthodontic band of the present invention permits an even spread of cementing medium between the tooth and the band. The fitting process involves shaping the band to a size just larger than the tooth to which it is to be fitted. Cement will then normally be placed on the inner surface of the band, or alternatively on the surface of the tooth (or both). The band is then fitted over the tooth. Because the band is slightly larger than the tooth, it easily fits over the tooth and minimises the forcing of cement out from between the band and the tooth. Subsequent tightening of the band evenly spreads the cement.

The locking means used on the orthodontic band is not intended to hold the band firmly in place on the tooth during the entire period of treatment, which may range in time from months to years. Rather, it is the cement that firmly bonds the band to the tooth. The locking mechanism is intended to hold the band closed and under tension whilst the cement is setting. It will be appreciated, however, that the locking mechanism should preferably remain closed for the entire treatment period.

The present invention also provides a method for placement of an orthodontic band on a tooth.

In a second aspect, the present invention provides a method for placing an orthodontic band on a tooth comprising the steps of providing an orthodontic band comprising a strip

of flexible material having co-operating locking means located at, adjacent, or near each end of the strip of flexible material, forming the orthodontic band into a shape that will fit over a tooth, placing the band over the tooth and tightening the band to cause the band to more closely conform to the shape of the tooth wherein an orthodontic cement is applied between the band and the tooth prior to tightening the band and the locking means holds the band in a closed, tightened configuration at least while the cement is setting.

The orthodontic cement may be applied between the band and the tooth by:

i) applying the cement to the inside surface of the band prior to placing the band on the tooth;

ii) applying the cement to the tooth prior to placing the band on the tooth; and/or

iii) placing cement between the band and the tooth after the band has been placed on the tooth.

Method (i) is the preferred method for applying the cement.

The step of forming the band into a shape that will fit over the tooth preferably forms the band into a shape that is slightly larger than the tooth and then placing the band over the tooth. If the band is shaped to be slightly larger than the tooth, the band will easily fit over the tooth and will not tend to force cement out of the space between the band and the tooth.

It is preferred that the step of shaping the band to fit over the tooth causes the locking means to interengage. Tightening of the band once it has been fitted over the tooth will then cause the locking mechanism to further interengage. It may also be possible that the locking mechanism may interengage only when the band is tightened.

The band may be placed from the lingual or palatal, in which case the locking means may advantageously incorporate or comprise the lingual cleats. This arrangement allows conventional buccal brackets to be placed on the band.

The band may also be designed to close on the buccal side, especially in the case of transpalatal appliances and this is advantageous in the placement of one side at a time.

Typically, molar bands are provided with buccal brackets. The locking means of the present invention may comprise a buccal bracket when the band is placed on the tooth and the locking means closed, (i.e. the locking means forms the buccal bracket).

The band is preferably placed in position with an implement or tool which allows easy access to the tooth and direct placement with easy adjustment before final adaptation. The implement preferably includes a first arm adapted to receive a part of the locking mechanism located at or near one end of the strip and a second arm adapted to receive a part of the locking mechanism located at or near the other end of the strip, with the first arm being moveable relative to the second arm to allow adjustment or tightening of the band.

The implement may suitably comprise a pair of pliers or a clamp, especially a substantially linear clamp. Such a clamp is preferred because it allows easy access to the tooth and mouth.

Alternatively, the implement may comprise a generally cylindrical sleeve having a first holding means to hold part of the band, a shaft extending through the sleeve, the shaft having a second holding means for holding another part of the band and means to adjust the distance between the first holding means and the second holding means. Preferably, the first holding means and the second holding means engage respective lingual cleats on the band. Preferably, the generally cylindrical sleeve is arcuate in a longitudinal direction to improve access to the rear of the mouth.

In another aspect, the present invention provides an implement as hereinabove described. The implement may be used to position conventional molar bands or molar bands in accordance with the invention.

The invention will now be further described with reference to the accompanying drawings, in which:

Figure 1 shows a first embodiment of an orthodontic band in accordance with the present invention, with the band being in a closed position,

Figur 2 shows another embodiment of an orthodontic band in accordance with the present invention;

Figure 3 shows a further embodiment of an orthodontic band of the present invention;

Figure 4 shows yet another embodiment of an orthodontic band in accordance with the present invention;

Figure 5 shows a front view of a band held in position by a clamp and ready for placement on a tooth;

Figure 6 is a plan view of Figure 5;

Figure 7 shows an exploded view of the clamp shown in Figures 5 and 6;

Figure 8 shows a schematic view of a band held in position by a pair of pliers and ready for placement on a tooth.

Figure 9 shows another embodiment of the present invention;

Figure 10 shows a side view of Figure 9;

Figure 11 shows the band of Figure 9 in a closed position;

Figures 12 to 14 show alternate details of the elongate extension of the band shown in Figure 9;

Figure 15 shows another implement for placing the band on the tooth;

Figure 16 is a side view of Figure 15;

Figure 17 shows another band in accordance with the present invention; and

Figure 18 shows the band of Figure 17 in a closed position.

Figure 1 shows an orthodontic band 10 comprising a strip of material 11, such as stainless steel, that is provided with a hollow tube 12 mounted at one end thereof and elongate rod member 13 mounted near the other end of the band. Rod member 13 is adapted to be receivable in hollow tube 12. Both tube 12 and rod 13 include outwardly extending projections 14,15, respectively which, in use, form the lingual cleat of the band. It will be appreciated that the band shows in Figure 1 may be supplied in an open, flat position and that Figure 1 shows the band shaped to fit over a tooth.

The band 10 shown in Figure 2 is generally similar to that shown in Figure 1 but it incorporates a different locking mechanism. Specifically, the locking mechanism includes a

sawtooth arrangement 21 that is adapted to be received within a corresponding sawtooth arrangement 22 mounted near the other end of the band. Insertion of sawtooth arrangement 21 into complementary sawtooth arrangement 22 causes the teeth of sawtooth arrangement 21 to interengage with the teeth of sawtooth arrangement 22 to thereby actuate the locking mechanism and close the band. Again, the locking mechanism of the band shown in Figure 2 includes projections 23 and 24 that, in use, form the lingual cleat of the band.

Figures 3 and 4 also show bands that are generally similar to those shown in Figures 1 and 2 with slightly different locking arrangements. The locking mechanisms used on the band shown in Figures 3 and 4 are similar to the rod and tube arrangement shown in Figure 1, but they incorporate a dual rod and tube arrangement. For example, the band 10 of Figure 3 includes a first locking mechanism 31 having hollow tube extensions 32 and 33. A corresponding second part of the locking mechanism 34 includes rod extensions 35 and 36 that are adapted to fit into hollow tube extensions 32 and 33, respectively. Outward projections 37 and 38 formed with the locking mechanism are used to form the lingual cleat of the band. Alternatively, the band shown in Figure 3 may be positioned on the tooth such that the locking mechanism forms the buckle bracket of the band.

The locking mechanism shown in the band 10 of Figure 4 is generally similar to that shown in Figure 3 but with detail differences in the design.

Figures 5 and 6 show one method of applying the band to the tooth. As can be seen from Figures 5 and 6, band 10 is formed into a shape that is slightly larger than the tooth. The band is held in this shape by inserting projections 14 and 15, which form the lingual cleat of the band into holes formed in arms 41 and 42 of clamp 40. Clamp 40 acts to hold the band in the desired shape and facilitates placing the band over the tooth. Once the band has been placed over the tooth (and the orthodontic cement has been placed between the tooth and the inner surface of the band) screw actuator 43 is used to close the arms of the clamps 41,42 together. This acts to tighten the band and to place the band in tension. Once the band has

been tightened to the required degree, the clamp in conjunction with the locking mechanism holds the band closed until the cement has fully set. The clamp is then removed.

Orthodontic band 10 should be of a length such that when placed on the tooth there is a small degree of overlap of the ends of the strip of material that forms the band. However, the degree of overlap should not be so large as to require trimming of excess length from the band once it is in place. This assists in only having to place the band on the tooth a single time.

Although not clearly described, it is also generally necessary to separate the teeth prior to placing the band into position, as is conventional in current techniques.

Figure 7 shows the clamp 40 used in the invention in greater detail. As can be seen, the clamp 40 includes a first arm 41 and a second arm 42. First arm 41 has an outwardly projecting and portion 41a having a hole 41b formed therein. Hole 41b is designed to accommodate projection 15 of the lingual cleat of the band. Arm 41 also includes a slot 41c that is designed to receive outward projection 42a of arm 42. Arm 42 can thereby longitudinally move along slot 41c. Arm 42 also includes hole 42b that can accept projection 14 of the lingual cleat. It can be seen that holes 41b and 42b provided in the arms 41 and 42 act to securely hold the band during placement and fitment of the band.

As can further be seen from Figure 7, arm 41 also includes threaded portion 41d. In use, outward projection 42c of arm 42 is placed over the threaded portion 41d, with the threaded portion 41d passing through hole 42d formed in outward projection 42c. A threaded screw 43 is then placed on threaded portion 41d and threaded screw enables adjustment of the distance between outward projections 41a and 42a of arms 41 and 42 to be carried out.

Figure 8 shows the use of plier to place the band on a tooth. The band shown in Figure 8 is generally similar to that shown in Figure 3. In Figure 8, pliers 50 having arms 51 and 52 are used to engage lingual cleat projections 37 and 38 of the band. Actuation of the handles 53 and 54 enable adjustment of the tension on the band. The plier 50 may also include a

ratchet mechanism 55 in order to hold the pliers in a desired position. In this regard, the pliers can act as clamping pliers.

Figures 9 and 10 show another band in accordance with the present invention. The band 60, for example, made of stainless steel, includes a main portion 61 and an elongate extension or tongue 62. Slots 63, are formed in one end of the band 60. Elongate extension 62 is produced with serrations 65. In use, the band is formed around a tooth and elongate extension 62 passes through slots 63, as shown in Figure 11. Serrations 65 act to increase the degree of friction fit between the elongate extension 62 and slots 63. The elongate extension 62 and slots 63, form corresponding locking means at either end of the band. Band 60 is also fitted with lingual cleats 66,67.

Figures 12,13 and 14 show alternative arrangements for increasing the friction between the elongate extension 62 and the slots 63. In Figure 12, the elongate extension is provided with saw-teeth 68. In Figure 13, a plurality of holes 69 are formed in the elongate extension 62. In Figure 14, notches 70 are formed in the elongate extension 62.

The band of Figures 9 to 12 is preferably supplied in a partly closed form in which the elongate extension 62 is entered into slots 63. The band may then be positioned over a tooth and tightened.

Another device suitable for positioning the band on the tooth and tightening the band is shown in Figures 15 and 16. This device 80 is a clamping implement that includes a generally cylindrical sleeve 81. As best shown in Figure 16, sleeve 81 is curved to enable better access to the rear parts of the mouth. One end of sleeve 81 is fitted with a holder 82 for holding one of the lingual cleats 83 of the band. A shaft 84 passes through sleeve 81. Shaft 84 has a holder 85 at one end for holding the other lingual cleat 86 of the band. Holders 82 and 86 may simply comprise projections that fit into holes in the lingual cleats 82,86. Other arrangements may also be used. Shaft 84 also has a screw-threaded end 88 extending from the other end of sleeve 81. Turn-wheel 89 is used to move shaft 84 into and out of the shaft 84.

In order to place the band on a tooth, the lingual cleats

are held by holders 82,85, as is shown in Figure 15. The dentist places cement on the inside of the band and then places the band over the tooth. At this stage, the band fits loosely over the tooth, which allows for easy placement of the band. Turn-wheel 89 is turned to close the distance between holders 82,85, which acts to tighten the band over the tooth and cause the band to squeeze the cement such that it spreads evenly on the contact surface between the tooth and the band. Once tightened to the required degree, implement 80 is removed from the band. Frictional forces between the elongate extension and the slots hold the band in place until the cement has set.

As can be seen from Figures 11 and 15, the band is closed such that elongate extension 62 lies under the main body portion 61. Consequently, there is no necessity to trim any excess length of the elongate extension from the band. Moreover, the cement tends to surround the elongate extension and when the cement sets it establishes both an adhesive bond and a mechanical bond with the band. This is accentuated when the elongate extension is provided with saw-teeth, serrations, holes or notches, as shown in Figures 9 to 14, as the cement can more readily surround the elongate extension. For example, when the elongate extension has holes therein, the cement can flow through and fill the holes when the band is placed on the tooth. When the cement has set, the cement that has filled the holes effectively forms solid columns of set cement in the holes. To remove the band from the tooth requires that the adhesive bond between the band and the tooth be broken and the mechanical strength of the columns of set cement be overcome. Thus, the use of a band which, when applied to the tooth, has a part underlying the band, can result in a strong bond being established. The cement may be considered to either partially or fully encapsulate the underlying part of the band.

Although not clearly shown in Figures 9 to 16, the band preferably includes contoured sides such that the band will more closely fit with the side profile of the tooth. The band may be shaped such that the side wall thereof is concave inwardly. This ensures a better fit with the tooth and assists in obtaining an even bonding of all the side wall of the band to its respective tooth.

Figures 17 and 18 show another embodiment of the band. This embodiment is similar to the embodiment shown in Figures 9,10 and 11, except that the band has only two slots 63a. In use, the elongate extension 62a may be passed through the slots and then folded back upon itself as shown in Figure 18.

The band in accordance with the present invention may be simply made by stamping or cutting from sheets of appropriate metal alloy or other suitable material. The band is simple to fit and it is possible that a dentist will only have to stock three or four sizes of bands to fit the molar teeth of any patient. At present it is necessary to stock up to 30 or more differently sized bands to fit the teeth of all patients.

The present invention allows a variable and adjustable molar band to be placed on the tooth by use of a removable clamp, which greatly facilitates placement.

The clamp tightens the band so that cement is spread evenly and completely under the band. In preferred embodiments, the cement closely adapts to serrations, holes or roughening on the tongue (elongate extension) of the band so that when the cement has set it forms a secondary mechanical locking mechanism as well as an adhesive bonding mechanism.

The band, because it can be tightened on the tooth and does not require removal after size is determined, is able to more closely contour to the surfaces of the tooth both occlusally and gingivally.

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically disclosed. It is to be understood that the invention is considered to encompass all such variations and modifications that are all within its spirit and scope.

CLAIMS:

1. An orthodontic band for placement on a molar tooth comprising a strip of flexible material having co-operating locking means located at, adjacent, or near to each end of the strip of flexible material.

2. An orthodontic band according to claim 1 wherein the locking means is a self locking device.

3. An orthodontic band according to claim 2 wherein the locking means comprises a friction fit arrangement.

4. An orthodontic band according to claim 3 wherein the locking means comprises a wire and tube arrangement in which a wire located at or near one end of the strip is adapted to be received in and held by a tube located at or near the other end of the strip.

5. An orthodontic band according to claim 3 wherein the locking means comprises a ratchet mechanism.

6. An orthodontic band according to claim 5 wherein the locking means includes a saw tooth extension receivable in a co-operable receiving means.

7. An orthodontic band according to claim 3 wherein the locking means includes an elongate extension at one end thereof and one or more slots formed in said material at or near the other end thereof, said one or more slots adapted to receive the elongate extension.

8. An orthodontic band according to claim 7 wherein the elongate extension includes means for increasing the strength of a friction fit with the one or more slots.

9. An orthodontic band according to claim 8 wherein said means comprises serrations or saw-teeth formed on the elongate extension, or surface roughening on the elongate extension, or notches or holes on the elongate extension.

10. An orthodontic band according to any one of claims 1 to 6 wherein the locking means also acts as a lingual cleat or a buccal bracket.

11. An orthodontic band according to any one of the preceding claims wherein said band is contoured on its inner surface to enable the band to closely fit to the tooth.

12. A method for placing an orthodontic band on a tooth comprising the steps of providing an orthodontic band

comprising a strip of flexible material having co-operating locking means located at, adjacent, or near each end of the strip of flexible material, forming the orthodontic band into a shape that will fit over a tooth, placing the band over the tooth and tightening the band to cause the band to more closely conform to the shape of the tooth wherein an orthodontic cement is applied between the band and the tooth prior to tightening the band and the locking means holds the band in a closed, tightened configuration at least while the cement is setting.

13. A method according to claim 12 wherein the orthodontic cement is applied to the inside surface of the band prior to placing the band on the tooth.

14. A method according to claim 12 wherein the orthodontic cement is applied to the tooth prior to placing the band on the tooth.

15. A method according to claim 12 wherein the orthodontic cement is placed between the band and the tooth after the band has been placed on the tooth.

16. A method according to claim 12 wherein the step of tightening causes plastic deformation of the band to ensure the band closely fits the tooth.

17. A method according to any one of claims 12 to 16 wherein the band is placed in position with an implement which includes a first arm adapted to receive a part of the locking mechanism located at or near one end of the strip and a second arm adapted to receive a part of the locking mechanism located at or near the other end of the strip, with the first arm being moveable relative to the second arm to allow adjustment or tightening of the band.

18. A method according to claim 17 wherein the implement comprises a pair of pliers.

19. A method according to claim 17 wherein the implement comprises a clamp.

20. A method as claimed in any one of claims 12 to 16 wherein the band is placed in position with an implement which comprises a generally cylindrical sleeve having a first holding means to hold part of the band, a shaft extending through the sleeve, the shaft having a second holding means for holding another part of the band and means to adjust the distance

between the first holding means and the second holding means.

21. A method according to claim 20 wherein the first holding means and the second holding means engage respective lingual cleats on the band.

22. A method according to claim 20 or claim 21 wherein the generally cylindrical sleeve is arcuate in a longitudinal direction.

23. A method according to any one of claims 12 to 22 wherein the cement flows around at least part of the band to produce an adhesive bond and a mechanical bond.

24. A method according to claim 24 wherein a part of the band underlies another part of the band and the cement flows around at least the underlying part of the band to form a mechanical band and an adhesive bond with the underlying part.

25. A method according to claim 24 wherein the underlying part has one or more holes therein and the cement flows through and fills the holes.

26. A method according to claim 24 wherein the underlying part has serrations, saw-teeth or notches and the cement flows around and fills the serrations, saw-teeth or notches.

27. A method according to any one of claims 17 to 26 wherein the implement is retained until the cement has substantially set and thereafter the implement is removed from the band.

28. An implement for positioning a molar band on a tooth comprising a generally cylindrical sleeve having a first holding means to hold part of the band, a shaft extending through the sleeve, the shaft having a second holding means for holding another part of the band and means to adjust the distance between the first holding means and the second holding means.

29. An implement according to claim 28 wherein the first holding means and the second holding means engage respective linqual cleats on the band.

30. An implement according to claim 28 or claim 29 wherein the generally cylindrical sleeve is arcuate in a longitudinal direction to improve access to the rear of the mouth.

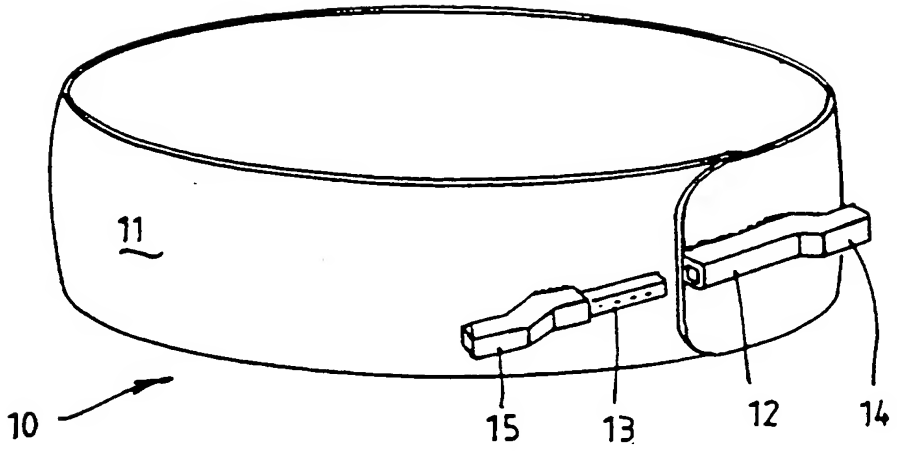


FIG. 1.

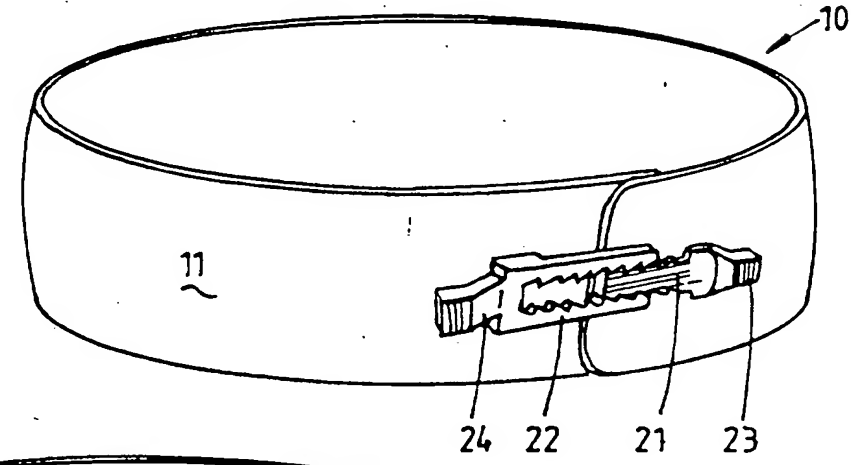


FIG. 2.

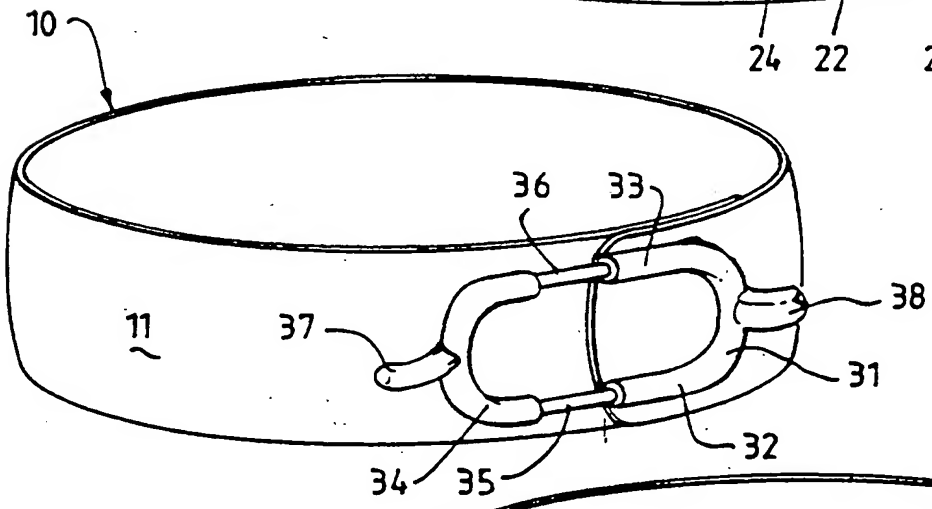


FIG. 3.

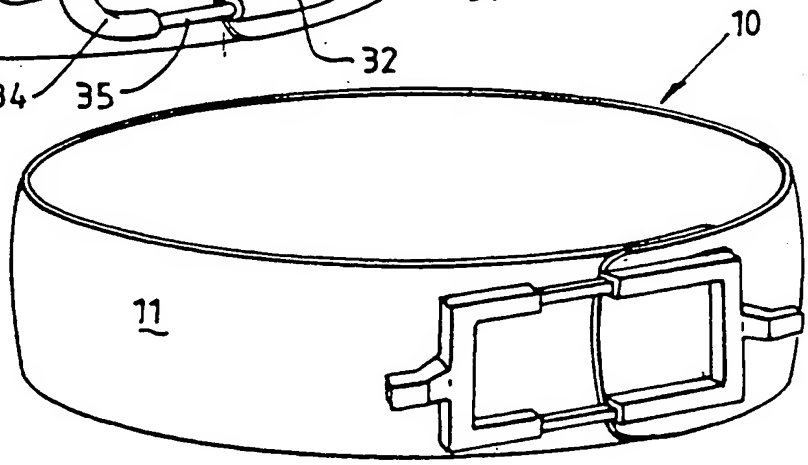


FIG. 4.

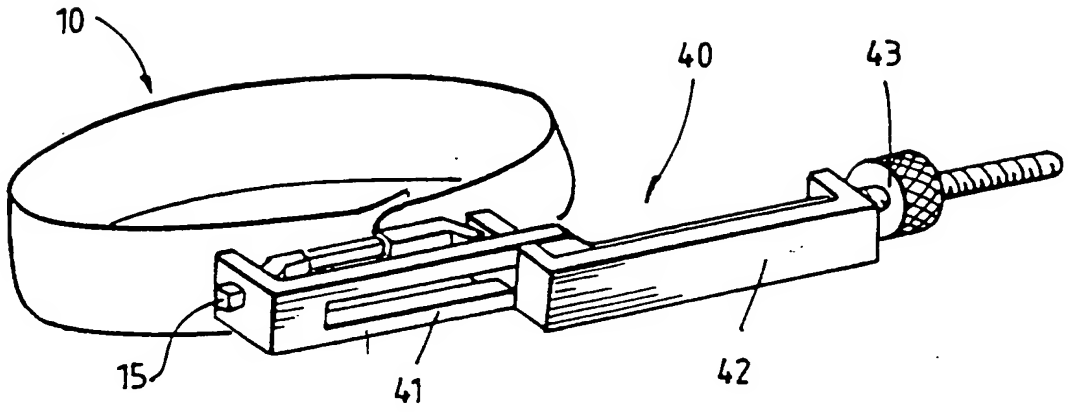


FIG. 5.

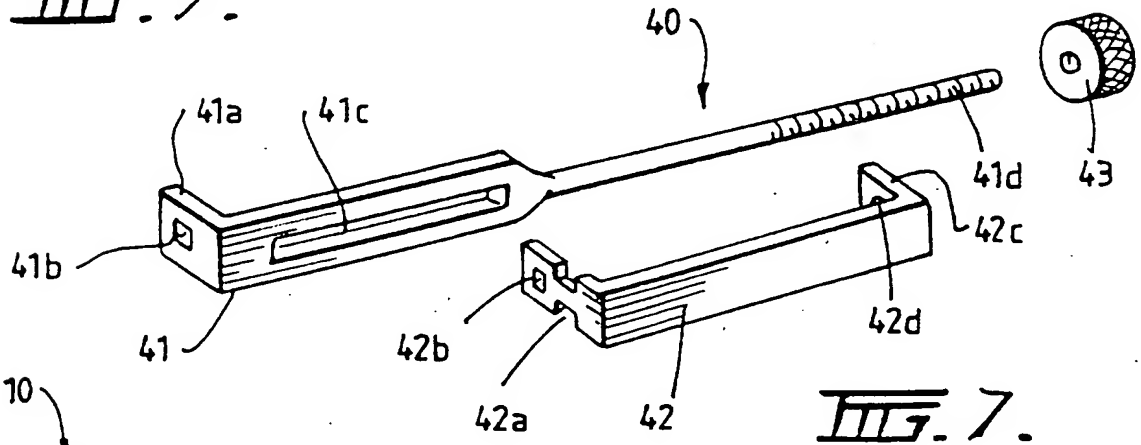


FIG. 7.

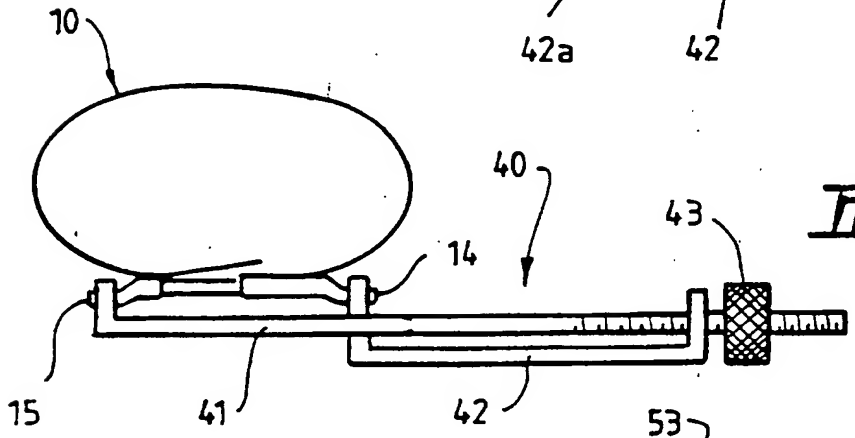


FIG. 6.

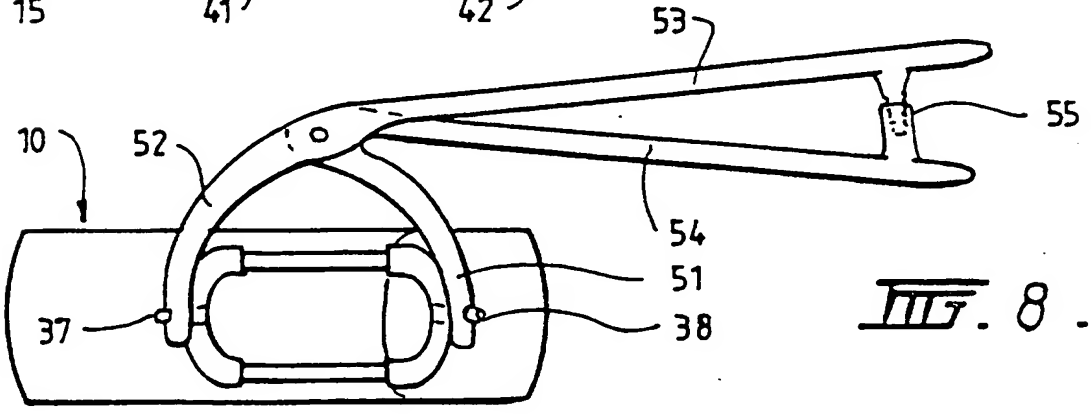


FIG. 8.

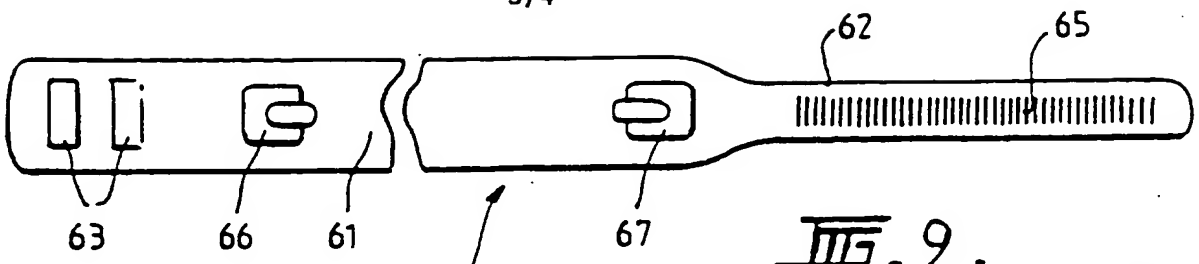


FIG. 9.

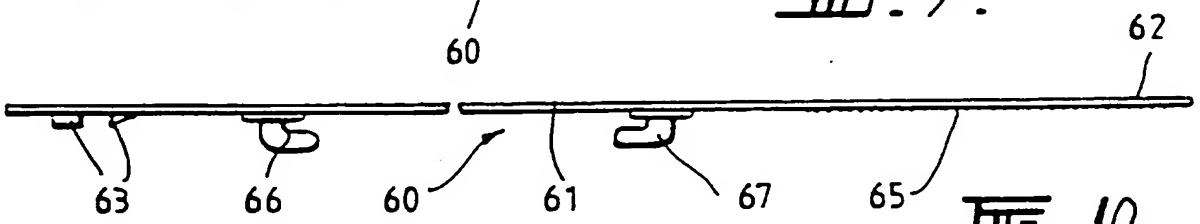


FIG. 10.

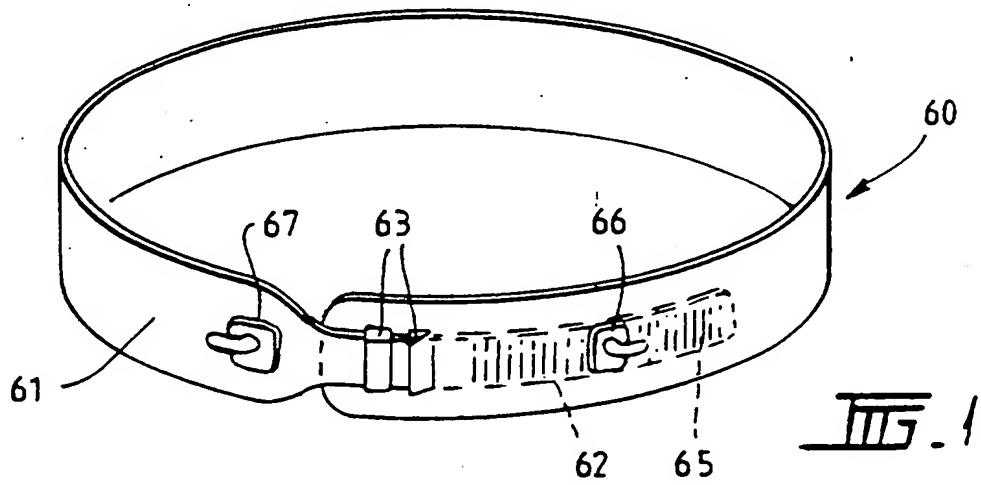
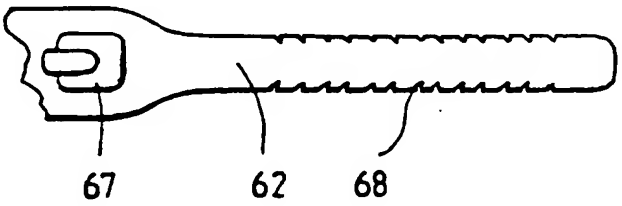


FIG. 11.

FIG. 12.



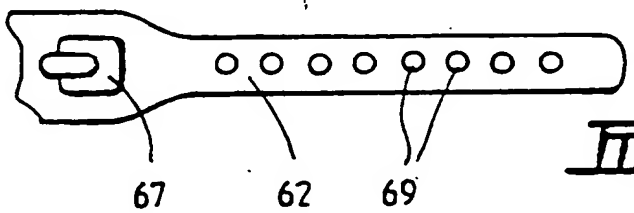


FIG. 13.

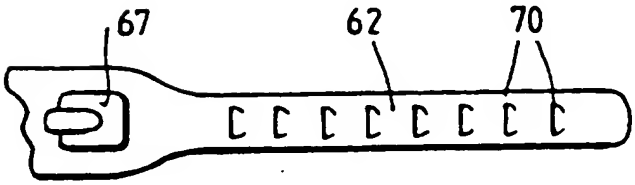


FIG. 14.

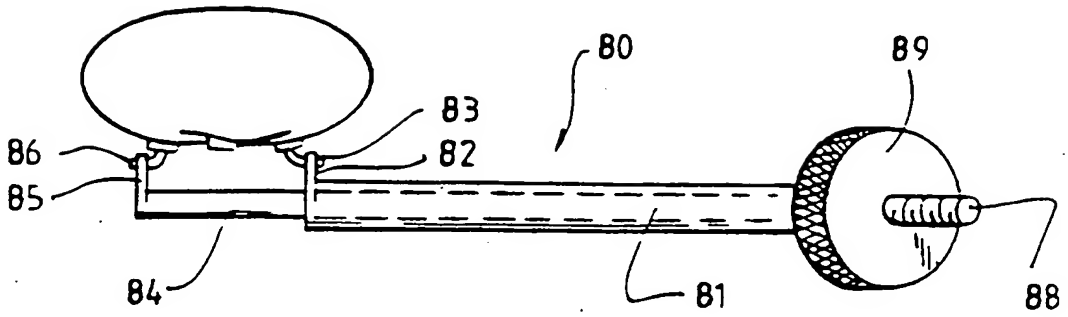


FIG. 15.

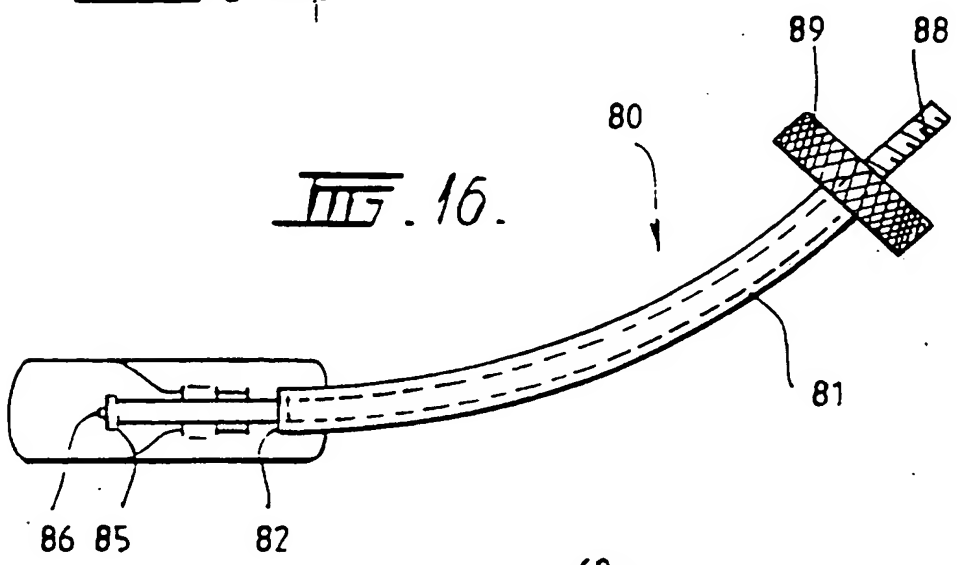


FIG. 16.

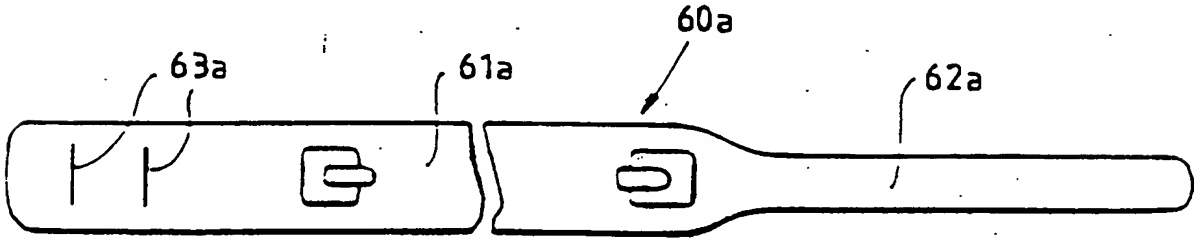


FIG. 17.

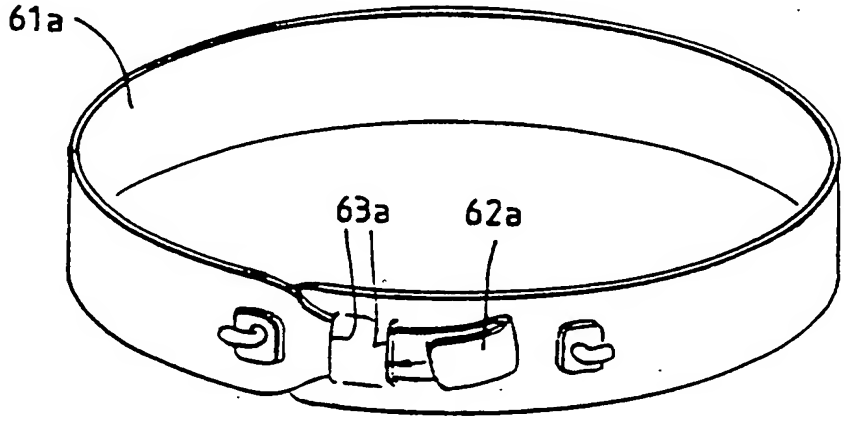


FIG. 18.

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 96/00131

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: A61C 7/18, 7/02, 7/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61C 7/18, 7/02, 7/04, 7/00, A61D 5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DERWENT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4167813 A (FÖRSTER) 18 September 1979 Column 2, line 21 - Column 3, line 46 and figures	1-3, 5-9, 12
X	US 3138872 A (LAZARUS) 30 June 1964 Column 2, line 42 - Column 3, line 14 and figures	1-3, 10-12
X	AU 1983/38 (107441) B (ROSENSTENGEL) 1 June 1939 Column 2, lines 5-18 and figures	1, 12

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
24 April 1996

Date of mailing of the international search report
7TH MAY 1996.

Name and mailing address of the ISA/AU
AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION
PO BOX 200
WODEN ACT 2606
AUSTRALIA Facsimile No.: (06) 285 3929

Authorized officer
MATTHEW FORWARD
Telephone No.: (06) 283 2606

Form PCT/ISA/210 (second sheet) (July 1992) copjhw

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 96/00131

C (Continuation) **DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007517 A (BOYD et al) 9 July 1935 Column 1, line 55 - column 2, line 29 and figures	1-3, 5-6, 12
X	AU 13052/28 A (WUNDERLY) 31 December 1928 Column 3, lines 1-16 and figures	1, 12
A	US 4669979 A (SNEAD) 2 June 1987 Whole document	28
A	US 4260374 A (KURZ) 7 April 1981 Whole document	28

INTERNATIONAL SEARCH REPORT

.rnational Application No
PCT/AU 96/00131

Box I **Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II **Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

See additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims

2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 96/00131

Box Continuation of box II

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single inventive concept. In coming to this conclusion the International Searching Authority has found that there are two inventions:

1. Claim 1 is directed to an orthodontic band comprising a strip of flexible material having co-operating locking means located adjacent each end of the strip. Claim 12 is directed to a method of placing an orthodontic band on a tooth comprising the steps of providing an orthodontic band comprising a strip of flexible material having co-operating locking means located adjacent each end of the strip, forming the orthodontic band into a shape over the tooth, placing the band on the tooth and tightening the band, and applying an orthodontic cement between the orthodontic band and the tooth.

It is considered that the orthodontic band having co-operating locking means adjacent each end which comprises a first "special technical feature" of Claim 1 and Claim 12.

2. Claims 28 to 30 are directed to an implement for positioning a molar band on a tooth comprising a cylindrical sleeve having a first holding means to hold part of the band, a shaft extending through the sleeve, the shaft having second holding means for holding another part of the band, and means to adjust the spacing between the respective holding means.

It is considered that the implement comprises a second "special technical feature".

Since the above mentioned groups of claims do not share either of the special technical features identified, a "technical relationship" between the inventions, as defined in PCT Rule 13.2 does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No.
PCT/AU 96/00131

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	4167813	CH	790914 A	DE	771124 A1	FR	771216 A1
		IT	891122 A	JP	771201 A2		
US	4669979	AU	870611 A1	CA	910723 A1	DE	910321 C0
		EP	870616 A1	JP	870827		
US	4260374						
							END OF ANNEX